Real Option Liabilities and New Product Development

Mark J. Shrader
Gonzaga University

Many financial academics and practitioners have long realized that the standard Net Present Value (NPV) model based on discounted cash flow (DCF) analysis does not always yield optimal capital budgeting decisions. Since DCF models ignore managerial flexibility, a real options component must be included to more correctly estimate the true NPV of capital budgeting projects. Existing financial literature linking real options to capital budgeting almost universally assumes that the option component is an asset to the firm. However, when firms evaluate new projects, potential future product liabilities are another source of options that must be considered. When firms sell risky products, they are in essence issuing product liability call options to consumers who may then exercise their rights to sue for product liability damages. Therefore, the standard NPV estimate must be reduced by the value of the call. To make this adjustment in practice, firms may elect to use Black-Scholes option valuation models, decision tree based models, or Monte Carlo simulations.

INTRODUCTION

Potential product liability concerns must be considered by managers in order to make optimal decisions regarding new product development. Managers need to estimate the effect of these future claims in order to determine key attributes of product design, appropriate levels of product safety testing, and marketing and pricing strategies as inputs into the capital budgeting process to establish the economic feasibility of the proposed product. Research in financial literature has not extensively developed appropriate methods for dealing with this problem. For example, many corporate finance texts completely avoid a discussion of future product liabilities in the capital budgeting process. Others mention their importance, but do not specifically address how they should be incorporated into the capital budgeting decision.

In practice, it is likely that most firms at least implicitly consider potential product liability claims in one of three ways, each of which would be expected to provide sub-optimal results. Some firms may calculate an expected value of product liability claims and incorporate that as a future cash outflow in a standard DCF model (NPV or Internal Rate of Return (IRR)). This approach is problematic because it does not consider the future flexibility that consumers have to determine whether or not to bring product liability suits against the firm. Other firms may employ (higher) risk-adjusted discount rates in their DCF models to compensate for the

additional risk of product liability claims for new products. A difficulty here is in the determination of the appropriate risk-adjusted rate to employ. In addition to the normal estimation problems as a result of the high level of uncertainty, note that product liability claims are an unsystematic risk, while the discount rate generally should be based on systematic risk. Other firms may choose to hedge the risk of incurring product liability claims by purchasing product liability insurance. While the cost of product liability insurance could be incorporated into the NPV model, this probably is not an activity that is consistent with value maximization. Although many firms choose various risk management techniques (derivative instruments) to hedge certain types of risk, these techniques generally are less costly than purchasing product liability insurance. Again, this may result in significant agency costs to shareholders since product liability claims are an unsystematic risk, and certainly can't protect fully against the indirect costs (reputational losses) of product liability claims.

This paper suggests that a more theoretically correct method for estimating product liability effects would be to employ a real options methodology. Although the addition of real options analysis has been shown to improve the standard NPV model, the literature almost exclusively has assumed that options add value to potential products. Some commonly cited examples are the option to expand, the option to contract or abandon, the option to defer investment, and the option to alter production methods or quantities. Copeland and Antikarov (2001) suggest that the standard NPV model, which does not account for managerial flexibility after the project is undertaken, systematically undervalues all projects. The lone exception to this general rule has been provided by Mahajan (1990), who considers the risk that host countries may expropriate the assets of multinational firms. In Mahajan's model, the option component is a liability to the firm. In essence, when a multinational undertakes physical investment in a host country, the multinational essentially is issuing the host country a call option, without direct compensation, to expropriate the invested assets. Unlike the other real options literature, Mahajan suggests that standard NPV models that do not incorporate this option value systematically overvalue the multinational investment.

Extending this real options concept to product liability concerns, firms that sell risky products are essentially transferring product liability call options, in conjunction with their products, to consumers. Consumers may exercise their options by bringing suit against the firm. Furthermore, the value of this option is dependent, in part, on the success of the product. Other things constant, higher sales levels and correspondingly higher firm values create greater incentives for product liability lawsuits to be initiated. As a result, NPV models that do not incorporate the value of this option would be expected to systematically overvalue the firm's decision to introduce new products.

This paper develops the necessity of utilizing product liability options in the decision to introduce new products. Initially, the paper examines the appropriateness of various risk management applications regarding product liability issues of new products. This leads to the development of the optimal NPV model adjusted for the effect of product liability in a real options framework. The paper concludes with a discussion of factors affecting the product liability option.

RISK MANAGEMENT AND PRODUCT LIABILITY

Meulbroek (2002) identifies three general areas whereby firms may engage in risk management activities. These include managing the firm's operations, managing the firm's

capital structure, and utilizing financial instruments for hedging purposes. Meulbroek argues that firms should integrate these three areas into a comprehensive, value-maximizing risk management plan.

The fundamental concept of value maximization is important as it applies to corporate risk management. Since risk management activities are costly and, to a large extent hedge against unsystematic risks, are they indeed value-maximizing actions? In a perfect market environment, they would not add value. However, certain market imperfections allow for some risk management activities to create value. Meulbroek notes that informational asymmetries between managers and investors concerning the firm's risk position may allow the firm to manage risks more effectively than investors. Stulz (1996) suggests that firms may undertake risk management activities to i) reduce the costs of financial distress, ii) reduce the risk of undiversified investors of closely held firms and/or iii) reduce the firm's tax liabilities by smoothing the earnings stream (given the progressive nature of the tax code). Froot, Scharfstein, and Stein (1994) suggest that firms use risk management to smooth their internally generated cash flow stream, thereby reducing the need to obtain costly external financing for new investment.

Since alternative methods of risk management have different costs and achieve different results, developing an optimal, integrated risk management plan is not trivial. Regarding the product liability risk of new products, risk management centers primarily on the firm's operations and use of financial instruments, with a lesser emphasis on capital structure decisions. Note that risk management in terms of the firm's operations generally would be associated with mitigating or controlling the risk, while risk management with financial instruments would be considered a transfer of risk. This is an important distinction with respect to potential product liabilities because of reputational effects that the firm may incur if it produces defective products.

Specifically, risk control in operations would be designed to reduce the risk of producing a defective product. This might include such things as product design, safety product testing, quality control, product packaging and warnings (Beatty, Gron, and Jorgenson, 2003)(Ryan, 2003). Risk transfer using product liability insurance is a hedge that becomes effective after a defective product has been manufactured and sold. Conceptually, risk management techniques in operations are more valuable because they protect against losses in value from deleterious reputational effects. While product liability insurance may limit the direct losses from product liability lawsuits, it does nothing to prevent damages of the firm's reputation. Jarrell and Peltzman (1985) find that the total costs to drug and automobile manufacturers of government recalls are 10-12 times the magnitude of the direct costs of the recall. This evidence supports the idea that government recalls create significant negative reputational effects for the firm. Prince and Rubin (2002) analyze this further. They estimate the loss in market value to drug and auto firms from the announcement of product liability lawsuits. They find that firms typically lose value (at the announcement) roughly equal to the worst-case scenario for the lawsuit outcomes (about 2.4% on average for auto firms and 1.64% for drug firms). They conclude that lawsuit announcements cause firms to incur some reputational damages, but not as much as the reputational losses suffered from government recalls. They interpret this to indicate that the market views product liability lawsuits by consumers as attempts to extract value from the firm, while government recalls are more indicative of safety or quality concerns.

Given the high cost of product liability insurance relative to the limited risk transfer benefits, and understanding that the transferred risk is unsystematic, it is questionable as to whether or not

the purchase of product liability insurance is a value-maximizing activity. It would seem that risk management actions pertaining to the firm's operations would be more appropriate.

Clearly, it is in the best interests of the firm to engage in product design and safety testing in order to reduce the risk of product liability lawsuits. What is not so clear is the determination of the optimal level of investment to expend on these activities. In general, it's not economically efficient to produce completely safe products. How, for instance, could automobile manufacturers produce a completely safe car? As a result, a firm can't expect to completely eliminate product liability risk. Therefore, it should be obvious that value maximizing capital budgeting decisions should incorporate this potential liability in some manner.

REAL OPTIONS AND PRODUCT LIABILITY

Mahajan (1990) examined the risk of expropriation of a multinational firm's assets by the host country. When a corporation invests assets in a foreign country, the host country holds a call option to expropriate those assets. Mahajan develops a model, NPV*, that explicitly includes the value of this option:

$$NPV^* = NPV - C,$$

where C is equal to the value of the call option to expropriate the assets. The value maximizing decision criteria, then, is to undertake the investment if $NPV^* > 0$. Note that, in this formulation, the multinational issues the call to the host country without direct compensation.

When consumers purchase a product they also receive a real option in the form of a call option to sue for product liability damages. This option can be thought of as one of many attributes of the product such as quality, color, safety, functionality, and durability. In a competitive product market environment, another product attribute, price, is related to each of these. However we measure quality, for instance, we would expect a direct relationship between quality and price. Higher quality products, in general, sell for higher prices. Similarly, there should exist a direct relationship between the value of the product liability call and the product's price. Clearly then, pricing decisions need to consider the value of this real option. This is another way of saying that firms are compensated for the value of the call. The more valuable the product liability option, the higher the price the firm can command, other things constant. It's interesting to note that there is another related, although opposing effect. Specifically, one of the factors that affects the value of the product liability option is the safety (inherent riskiness in terms of injury) of the product. Other things constant, less safe products generally command lower prices.

More importantly, for capital budgeting purposes, there also generally is a direct relationship between product quality and manufacturing cost. Other things constant, higher quality products are more costly to produce. And production costs are a direct input into standard NPV estimates and capital budgeting decisions. Although an indirect cost, the value of the call must be considered for the capital budgeting decision to be considered optimal. In order to do this, the value of the product liability option must be estimated. This value could then be included in a manner similar to Mahajan' model, where C would include the value of the product liability option.

VALUING PRODUCT LIABILITY OPTIONS

Product liability options are complex options because of the multiple sources of uncertainty that affect the option value. The riskiness of the product, in terms of it being found defective, is a fundamental valuation factor. The riskier the product, the higher the option value should be. Another source of uncertainty is the value of the equity of the firm. In a Black-Scholes framework, this can be thought of as an upper bound on the value of the underlying asset. Note that this is influenced directly by the success of the new product as well as by other systematic and unsystematic risks that affect equity value after the product has been sold. The higher the value of the equity, the more potential value that can be extracted from the firm in a product liability lawsuit, and the higher the value of the option should be. Also, as higher quantities of the product are sold, there is more of an incentive for a class action lawsuit because of economies of scale in the litigation process. There also is uncertainty regarding the maturity of the option. The longer the product will be in production, the longer the potential maturity of the option, and again, the higher the value should be. Uncertainties regarding the legal environment in the future also affect the value of the option. Although product liability cases became more prevalent beginning in the 1970's and 1980's, the pendulum might be swinging back the other way, with more limited damages being available in the future.

As a result of these multiple uncertainties, option valuation with the Black-Scholes model may be difficult and imprecise. For practical applications, firms may find decision tree based models and Monte Carlo simulations more appropriate.

REFERENCES

Beatty, A., A. Gron, and B. Jorgenson. (2005). Corporate Risk Management: Evidence from Product Liability. Journal of Financial Intermediation, 14, (2), 152-178.

Copeland, T. and V. Antikarov. (2001). Real Options. New York: Texere.

Froot, K., D. Scharfstein, and J. Stein. (1994). A Framework for Risk Management. Harvard Business Review, 72, (6), 91-102.

Hevert, K. (2001). Real Options Primer: A Practical Synthesis of Concepts and Valuation Approaches. Journal of Applied Corporate Finance, 14, (2), 25-40.

Lessard, D., 1985, "Capital Budgeting in a Latin American Content," working paper, MIT.

Mahajan, A. (1990). Pricing Expropriation Risk. Financial Management, 19, (4), 77-86.

Malone, D., K. Rascati, and J. Martin. (1999). An Analysis of the Product Liability Costs Borne by Prescription Drug Manufacturers. Research in Finance, 17, 173-189.

Meulbroek, K. (2002). A Senior Manager's Guide to Integrated Risk Management. Journal of Applied Corporate Finance, 14, (4), 56-70.

Prince, D., and P. Rubin. (2002). The Effects of Product Liability Litigation on the Value of Firms. American Law and Economics Review, 4, (1), 44-87.

Ryan, K. (2003). Product Liability Risk Control: Seven Keys to Success. Professional Safety, 48, (2), 20-26.

Stulz, R. (1996). Rethinking Risk Management. Journal of Applied Corporate Finance, 9, (3), 8-24.